

Russia and Neighbouring Countries: Environmental, Economic and Social Impacts of Climate Change

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Introduction

This year may mark a turning point in history when people—citizens and leaders alike—finally began to really address the urgent problem of climate change. Extreme weather, such as Hurricane Katrina, and severe floods in Europe, Africa and India, appears to have become more frequent. It has become increasingly likely that these are not simply freak events but part of a larger pattern of destruction caused by global warming.

Scientists have reached overwhelming consensus that human behaviour, especially the burning of coal, oil and gas and the destruction of forests, is the principal cause of the greenhouse effect. The real danger of climate change lies in the fact that even with an average temperature rise still less than 1°C, life is becoming less sustainable and extreme weather events more common in certain regions. And the temperature is going to rise more. Scientists believe that an increase of 2°C could tip the climate system into new and unpredictable states and must be avoided at all costs.

Though climate changes were often observed in the past—in the Middle Ages Greenland was so named for its lushness, and people in England grew grapes—what makes today's warming so dangerous is the unprecedented speed at which greenhouse gases—particularly carbon dioxide—are concentrating in the Earth's atmosphere as a result of human activities, causing temperatures to rise worldwide. This warming spans all continents and oceans.

Human-caused climate change stands as the major global challenge of the 21st century. Poor countries will suffer most, but neither rich nor northern countries will be able “to wait it out.” This report examines climate change in Russia and its neighbouring countries. Using case studies from the Arctic Region and the river valleys of central Russia, it surveys the effects of climate change on the environment, the economy and society and pays special attention to the lack of drinking water and the spread of diseases. It is our hope that this report will serve as a call to arms to arrest the damage, and support the people suffering most. If ignored, worsening conditions could render habitats barren, causing the extinction of species and the migration of millions of people.

WWF and Oxfam are major international non-governmental organisations dealing with environmental protection, poverty and health, and have been actively involved in finding solutions to climate change. WWF has launched a special energy programme and their 2007 report “Solving the climate change problem, WWF prospective vision of 2050” concludes that the world community can solve this problem and avoid catastrophic consequences of climate change—but only with swift and resolute action. This effort requires the cooperation of all countries. But whether the damage can be curtailed and the trends reversed will depend on when we start acting, and some trends—like glacier melt—are already irreversible.

Change also needs to happen on an individual level. Everyone—politicians, business leaders, adults and youth—needs to grasp the problem and change the way he or she thinks. People need to put aside their short-term interests and plans and act for the common good of the planet. As the former UN Secretary General K. Annan put it “The question is not whether climate change is happening or not, but whether, in the face of this emergency, we ourselves can change fast enough” (Nairobi, November 2006).

Environmental impact

Global climate change may appear to be a gradual warming; but it causes sudden and severe shocks that disrupt the entire climate system, causing floods and droughts, heat waves and rapid frosts, tornados and heavy snowfalls. The incidence of such events in Russia has spiked – in 2006 there were 387 cases; in 2007, 436ⁱ – and the cost has skyrocketed. Damage estimates have reached 30-60 billion rubles per year.ⁱⁱ

Extreme weather is worst from April through October but is also becoming more common in the winter months. In Russia, floods account for more than half of all economic losses. In 2001, a national tragedy occurred when floodwaters nearly washed the town of Lensk in Yakutia off the face of the earth. The government had to build new houses for flood survivors and restore the city's infrastructure. Experts predict catastrophic floods in St. Petersburg within the next 5 to 10 years, lending urgency to the project of finishing its flood protection system.ⁱⁱⁱ

Water resources

Russia possesses one fifth of the world's fresh water reserves, but they are unevenly distributed. The central and southern regions, where 80 percent of the country's population and industry is located, have only 8 percent of water resources. During the last few decades, climate change has wreaked havoc on Russia's rivers. Most of the annual runoff – some 15 to 40 percent – has occurred in European Russia, southern regions of West Siberia and part of the Lena River basin. Winter runoff in southwestern regions of European Russia exceeded its longstanding average by 50 to 100 percent.^{iv}

In Central Asia, glaciers are shrinking at an alarming rate, reducing the amount of runoff to the region's rivers.^v In Tajikistan, thousands of small glaciers are disappearing, and by mid-century, Kazakhstan's South Jungaria glaciers may totally vanish.^{vi} With rising temperatures, more rainfall will not help, as most rainwater simply evaporates before it reaches the rivers.^{vii}

But the region's main problem is its irrational use of water. Soviet planners turned Central Asia into a cotton colony and converted vast swaths of desert into irrigated farmland. Water from the Aral Sea's twin tributaries, the Syr Daria and the Amu Daria, is diverted to irrigate fields before it reaches the sea.

Farmers today continue to use outdated irrigation techniques that result in massive water loss. Over 8 million hectares in Central Asia are irrigated, and only 21 percent of irrigation water is used effectively. The Karakum canal, the region's main water supplier, is neither lined nor covered, leading to waste through seepage and evaporation.

Decades of water waste have culminated in an environmental catastrophe. The costs are staggering: the near total loss of the Aral Sea, degradation of the sea's coastal economy and the lower Amu Daria region, and mass migration of local people. In this way, climate change and poor environmental management interact and reinforce each other's negative consequences.

Climate effects on permafrost

Permafrost covers about 25 percent of the North Hemisphere and more than 60 percent of Russia's territory. Since the 1970s scientists have tracked the rising temperatures and the deepening of permafrost's summer thawing. In several regions the permafrost area has been shrinking. These changes are seriously impacting natural ecosystems, the economy of the Polar Regions, and people's lives.

How does permafrost degrade? Think of Swiss cheese. Permafrost can be compared to the ripening of Swiss cheese with plenty of air bubbles inside. The impact of climate change will first be seen in changes in the temperature and the depth of permafrost's seasonal thawing. "Bubbles" of thawed soil, or taliks, will emerge and eventually grow in size. They then combine before going deep into the soil where they displace frozen rocks in discontinuous and island permafrost zones. Even near the permafrost's southern border the thawing process is expected to go rather slowly. It will be decades before the 10-metre thick frozen layer totally disappears but the process is already well underway. In the last few years locals in North Yakutia have started growing potatoes in an area where, historically, the soil did not even melt in summer.

The relationship between climate change and permafrost is complicated. The process of global warming has accelerated the destruction of permafrost. And it has been posited that changes in permafrost may, in turn, accelerate the global warming processes.

In recent media reports some people argued that thawing permafrost would release a big amount of methane, which is approximately 22 times as potent a greenhouse gas as CO₂; as a result, the warming effect would substantially increase.

A recent study by Russian scientists has indicated these fears could be exaggerated. Their data suggests that although permafrost methane emissions in Russia are increasing they will hardly affect the climate. According to the data, by 2050 the additional rise in the earth's temperature caused by this particular mechanism will not exceed 0.01°C.^{viii}

While melting permafrost may not affect the atmosphere as much as had initially been feared it undoubtedly destroys the land. Thawing permafrost causes considerable damage to the region's infrastructure. The Far North's roads, oil and gas pipelines, reservoirs, facilities, oil and gas industries, and buildings are vulnerable as the ground beneath them shifts. More than 30 percent of explored oil reserves, about 60 percent of natural gas and large coal- and peat-beds are concentrated in Russia's northern regions, and the broad infrastructure serves the needs of mining industries that have been developed there. Many dwellings are built on piles set on the frozen soil; their stability depends on certain temperatures being maintained.

The melting of permafrost lowers the ground's carrying capacity and threatens the foundations of houses and constructions. Sinkholes can form and threaten roads, landing strips and pipelines. In the last 30 years in Yakutsk ground slump damaged more than 300 buildings. In June 2002 a Chersky settlement apartment building in the upper Kolyma region was ruined because of thawing permafrost under the building's foundation. In summer 2006 at the parking place in Yakutsk several cars fell into the huge crater caused by thawing permafrost.^{ix}

The highest risk regions include Chukotka, Upper Indigirka and Kolyma river basins, South-East Yakutia, most parts of the West Siberian valley, the Karskoe sea coast, Novaya Zemlya (New Land) and, partially, some northern regions of European Russia. All those regions have well-developed infrastructure, i.e. gas and oil mining complexes, Nadym-Pur-Taz pipeline system located in North-West Siberia, and Bibilinskaya atomic power station. Thawing permafrost in Novaya Zemlya (New Land) regions where radioactive waste repositories are located is especially dangerous.

In the southern area, permafrost patches will continue to thaw and could completely melt in several decades. In the coldest northern zone, with permafrost covering more than 90 percent of the territory, the seasonal thawing will increase in depth. Taliks may emerge and develop under big rivers and lakes so permafrost will be torn off from the surface and preserved within the deeper ground layers.

The Arctic is melting

Climate change is already having significant impact on the Arctic. Change in the northern regions, compared to rest of the Earth, is happening 1.5 – 2 times faster. Just in the last few years, the temperature has risen by up to 4°C. Winter is becoming warmer faster than summer, while deep freezes of rivers and lakes are becoming shorter. Over the last 30 years the snow period has reduced by an average of 2 weeks.^x The shrinking of the total iced area in 2005 – from 75 million square km to 55 million square km– was dramatic. In 2007, a record 4.3 million square km vanished.^{xi}

Local people are distressed. Victor Tkachenko, a resident of Ryrkarpiy settlement in Chukotka, says “Previously one could go seal–hunting on the ice until the end of June; now it is dangerous to walk on the ice as early as in May. Thaws with rains may occur even in January. I can’t recall such things happening before. Some places that used to be covered with ice crust all year round are melting everywhere now. Due to the heat berries become overripe, jelly-like and not tasty. We are running out of cloudberry because of the hot summer.”^{xii}

Gregory Rykhtyn from Vankarem settlement believes that “Nature got much worse, people have offended Nature. Spring comes 2 to 3 weeks earlier than before. Spring is getting harsh; it is raining or snowing all the time. The first rain is in May; it has never been like that before. The first thaw is in the end of April. The ice starts drifting on May 25, almost three weeks earlier than the usual target dates of June 10 – 15. Summers have become unbearably hot. There is no good ice on the sea anymore. The sea ice usually started breaking in the middle of May, but the ice floes did not drift too far. We could hunt on the ice all summer round.”^{xiii}

Polar bears – “masters” of this area – are also suffering from climate change. In spring they used to hunt seals on the ice. However, during recent years traditional seal–hunting has become problematic in Chukotka. Ice starts melting early and ice floes are drifting far from the seacoast. As a result, bears are separated from their traditional hunting area by wide sections of water and have to leave their natural habitat. In search of food, they are coming to the settlements.

In Vankarem settlement, the local people urgently had to create the special “Bear Patrol” team. Polar bears are gradually adapting to new conditions and are starting to hunt walrus. They have been seen for the first time in areas such as in the mouth of the Kolyma River. The migration of polar bears and their adaptation to new areas can provoke conflicts with people.

Global warming has also created gridlock in the Arctic. Roads are now freezing later and melting earlier than before, making them unusable for greater stretches and stranding people in their settlements. This has made working in the tundra even more difficult. Off-road vehicles can cause lasting environmental damage: the trail left after such passage may stay there for decades. That’s why many Arctic areas prohibit summer driving.

Maria Chistopolova from Paratunka settlement says that relatively warm and frostless winters, cold and foggy summers, late snow and the shrinking iced areas on rivers have become typical for Kamchatka regions. “Now there are frogs in the tundra – there have never been frogs over there... Besides, mosquitoes have become larger, and their bites are more painful.”

Reindeer breeders complain, “November thaws, especially when it rains, are doing great harm to the reindeer-breeding. There used to be thaws before but without rains.” The prognosis is poor: spring thaws immediately followed by frosts will become more frequent; when an ice crust forms reindeer cannot get the forage out of snow. Late freezing of rivers makes it difficult to drive reindeer. Thus, even now the reindeer breeders of Kola Peninsula often cannot drive flocks to the slaughter stations in the western parts of the region in December; instead, they have to do it in February when the quality of deer meat is worse and prices are lower.

People may point to some apparent benefits. For example, the melting of sea ice will improve navigation in Arctic waters. By the end of the 21st century the duration of the navigation at the “narrow place” of Vilkitsky Bay, which is only passable for 20 to 30 days on average, may be clear for up to 120 days.^{xiv}

But do not expect smooth sailing. Ships will have to negotiate ice fields and drifting icebergs. Ice destruction in Severnaya Zemlya (North Land) and Novaya Zemlya (New Land), Alaska and Greenland increases the danger of collisions. The destruction of glaciers causes the formation of icebergs, as big ice blocks slip into the ocean. Mobile ice fields make for treacherous conditions. Satellite monitoring systems can help ships steer clear of ice, but stationary gas platforms will become increasingly vulnerable.

Economic impacts

For a small number of countries, including Russia, global warming when measured by some criteria may not be considered a bad thing. The Russian economy has benefited from a shorter heating season as warmer weather has reduced the use of fossil fuels.

By 2025, the duration of the heating season is expected to decrease by 5 percent for most of Russia’s territories.^{xv} Already there are fewer winters with temperatures so frigid that they threaten winter crops. In many regions the vegetation period has increased by 5 to 10 days. The vegetation period for field crops has also lengthened. In Stavropol

territory the rated grain crop capacity has increased by 30 percent due to climate change.^{xvi}

However, any positive effects of climate change in the region are counterbalanced by a variety of negative impacts, as the preceding and following sections illustrate. Analysis of the impact of climate change on agriculture, for example, should clearly distinguish between what is happening *now* and what will happen *in the future*. This distinction is critically important: for most Russian territory the general trend is expected to change from slightly positive to substantially negative.

Climate change will have a direct or indirect impact in almost all economic areas. Those sectors depending directly upon natural and climatic conditions – including agriculture and forestry, water supply systems, buildings and engineering constructions, transportation infrastructure in the permafrost zones – are obviously most vulnerable to climate change, with water becoming the most destructive consequence of global climate change for the south of Russia and neighbouring regions.

In the past two years, winter weather has become unstable. In 2005 – 2006, European regions of Russia and in the Ukraine experienced protracted frosts. Electric power and heating systems were pushed to their limits. Some regions ran out of gas causing facilities to be shut down. Everyone was afraid of a repeat in 2006-2007 and precautionary plans for forced powercuts were put in place. However, last winter turned out to be surprisingly warm in Russia and, more importantly, there were no long-term frosts. So energy companies saved large amounts of fuel.

Russia is experiencing increasingly unstable weather conditions: unseasonable, abnormally warm and cold weather, frosts, strong wind and snowfalls are expected to happen more often both within the heating season and afterwards. The additional energy and fuel resources that may be needed to mitigate the impact of this instability serve to offset any fuel savings that may be caused by the overall warming trend.^{xvii}

Changing precipitation levels is another unknown and equally menacing factor. Reinforcing dams and other hydro technical facilities may be necessary to protect territories from the consequences of natural disasters. Thawing permafrost, the increase of subsoil water level, and floods increase the operational load of various technical constructions like pipelines, which could disrupt oil outflows and gas emissions. Russia's northern regions, where most of the pipelines are located, are most vulnerable.

Climate change also affects the timber industry. While conditions required for the normal growth and development of the main timber species in Russia are not expected to worsen over the next 30 – 40 years,^{xviii} warm winters could activate pests, as has already happened in Archangelsk region. During the warm winter of 2006-2007 transporting timber in Kostroma region became a big problem. If cut timber is not transported quickly, rotting logs can breed pests.

Forest fires are another hazard. By 2015, most Russian territories will see the number of high fire risk days increase by 5 days per season. A high fire risk situation will be the longest (more than 7 days per season) in southern regions of Khanty–Mansi autonomous county as well as in Kurgan, Omsk, Novosibirsk, Kemerovo and Tomsk regions, Krasnoyarsk and Altai territory and the Republic of Sakha.^{xix}

Drought has lessened the grain and forage capacity of several eastern and southern regions of Russia.^{xx} The total number of farm animals and wild animals has decreased. For example, the 2002 summer drought in Chita region destroyed 70 percent of crops, and due to the fodder shortage the total number of farm animals dropped considerably.

The general climate change trend for the country may be characterized as “the dry warming.”^{xxi} In the zones where drought periods are most likely to be strengthening – the North Caucasus, the Volga region, Rostov and Volgograd regions, steppe regions of the Urals and West Siberia – the adaptation measures should mainly focus on sowing aridity-proof cereals like corn, sunflower and millet, and winter crops.

In those regions heavily dependent upon irrigation, water-conservation measures should be implemented, water-saving technologies introduced, and protective forest belts installed.

Water supplies are especially crucial for the economy of Central Asian countries. Regions where mountain glaciers supply rivers with water while valleys are covered with deserts suffer from erosion and saline soils. As a result of melting glaciers, the danger of mudslides in the mountain and foothill regions will increase and should be taken into account when building new houses and settlements. Measures must be taken to protect existing towns and settlements.

The aggregate assessment of climate change problems related to water resources and foodstuff shows that crop capacity could plummet if the global temperature rises by only 2°C. If the global temperature were to rise by 4°C, most Central Asian lands could become barren by mid-century.

The impacts of climate change on Central Asia's economy and agriculture will be much stronger and more negative than on Russia's. It may cause serious food and social problems, “climatic” migration of millions of people, and the escalation of diseases.

Droughts, desertification, soil erosion and salinisation, frosts and thaws could be devastating. That is why it is important to monitor any rapid changes in this region's ecosystems.

Social impacts

Climate change does not happen in isolation. It interacts with existing problems and challenges that make people vulnerable. These include poverty, limited access to clean water and to electricity, and women's inequality.^{xxii} Billions of the world's poorest people are vulnerable to the effects of climate change, including the spread of malaria and other diseases, more frequent droughts and rising ocean levels. This further undermines their health and well being and makes them poorer, in a vicious downward spiral. In many societies women are the main growers of food crops, the main fetchers of water and firewood, and the main carers of children. As such, they are more directly dependent than men on natural resources and suffer first and most when those resources become scarce.

Reducing vulnerability by tackling poverty, ill-health and desperation is essential to help people cope better both with existing climatic shocks, and with the larger climatic

changes induced by global warming as they really begin to strike in the near future. It therefore has a positive effect – both immediately and for the future.

As has already been mentioned, the strongest climate change consequences will be in the Arctic region due to the danger of thawing permafrost and permafrost degradation. Here, social impacts of climate change will be felt most by indigenous minorities, whose social systems have traditionally been oriented towards both social networking and maintaining people's balance with the highly vulnerable environment, having successfully adapted to living in the extreme environmental conditions that the Arctic presents. Due to climate change, food preservation in this region could become problematic, resulting in an increase in intestinal diseases – a trend that has been seen in North Canada.

In the Southern regions of European Russia and the Urals, the summer air temperature could jump and precipitation levels fall, causing more droughts and potentially contributing to an increase in ill health, or deaths, due to airborne dust and other pollutants. Other social impacts in these areas include a lack of water, soil salinisation, and food shortages which result in poor nutrition. Even now in some regions of Kalmykia the daily average consumption of water is only 7-10 litres per person. During droughts the incidence of contagious diseases and mosquito-transmitted diseases can also rise.

In big cities climate change is considered one of the most important health risk factors, alongside air and water pollution, smoking, and drug use. According to a WHO assessment, climate change is currently causing up to 150 thousand deaths a year globally. WHO General Director Margaret Chan believes that “healthcare systems in all countries should be adjusted to climate change.”

Global warming increases the number of abnormally hot and cold days, which are felt most by the elderly, and affects the death rate. Sustained hot weather is increasing the number of deaths and heart diseases. Hot days exacerbate some symptoms of heart diseases, like chest and thorax pains, headaches, dizziness, sickness, and exhaustion. The high-risk groups include children, the elderly, outdoor workers, and people with low-income. In big cities risk groups include people living or working in “heat islands.”

Lasting heat periods threaten Magnitogorsk, Norilsk, Chita and other cities with large pollution sources and poor conditions for dispersal of pollutants. In the near future the danger of high temperatures and air pollution could conspire to negatively impact people's health. This is especially so for many cities dependent on coal energy, such as the southern regions of West Siberia, where the air is already polluted.

To lessen the negative health impacts a broad range of preventive measures should be put in place. France provides an example for Russia: it has developed a so-called “Blue plan” stipulating special rooms equipped with air conditioners in homes for the elderly and in health care institutions. Another plan, the “White Plan,” aims at implementing additional measures in hospitals and providing more equipment for emergency medical services. The National Plan of Action provides a model for local action plans at the prefecture level.

Increased risks for spreading contagious diseases

Even seemingly insignificant climate changes may alter the balance of species in ecosystems, making some species vanish and allowing new species to enter those ecosystems. Carriers of contagious diseases that affect plants, animals and people are constituent parts of all ecosystems; due to climate change they may increase or decrease in numbers as well as migrate to new areas. Climate change is often the trigger for species on the move.

Acute intestinal diseases

Global warming is one of the risk factors for spreading intestinal diseases. Over the last years in some countries the rise in average temperature has already increased the number of such diseases as bacterial dysentery, salmonella and others. The temperature is an underlying factor for attracting vermin, particularly flies, rodents and cockroaches, to food. The temperature affects flies' activity more than biotic factors. In countries with moderate climates warm weather and mild winters can mean more flies and other summer pests, which can appear as early as the beginning of spring.

Access to clean water remains a very important healthcare issue. Dysentery is widespread in territories lacking good water supply systems. These include Tuva, Buriatia, Udmurtia, Marij Al, Udmurtia, Chita, Tyumen and Sakhalin regions. In these regions, as elsewhere, it is poor people who most often lack quality drinking water.

Climate change puts additional stresses on water supply systems. Well-regulated community water supply systems must be capable of withstanding climate extremes. On the one hand, during drought periods lower rainfall may reduce the surface water flow thus affecting the quality of surface drinking water sources. On the other hand, the irregular water supply, which is typical of some settlements in Russia's southern regions and Far East, is breaking normal sanitary livelihood conditions.

Changing livelihoods and forced migration

All over Central Asia there will be increasing demand for water for irrigation purposes, human use and hydropower stations. Climate change consequences don't happen on their own but rather exacerbate the already existing serious stresses on the environment, ranging from the removal of forests, to impoverishment of soils, and water pollution, which – in turn – negatively affect people's lives.

Dr. Stephan Harrison of Exeter University, England, one of the world's foremost experts in glaciers, has observed the accelerated melting and destruction of glaciers in several countries of Central Asia and China. Glacially fed rivers supply irrigation systems essential to agriculture and also drinking water to big cities like Almaty. He warns that glaciers in Kazakhstan are melting so fast that the livelihoods of millions of people will be affected with "profound political, economic and social repercussions." He notes that "sustainable water resource use cannot be achieved without a high level of political agreement" among all countries in the region, including China.

Detailed assessments calculating likely losses and migration flows have not yet been undertaken for Central Asia. However, given growing social problems, social losses for poor countries may be huge – considerably exceeding 3 to 6 percent of possible

economic growth. Countries will become poorer and life there will get harder which will add to the pressure on people to migrate. This process may have already begun.

Where the least offenders pay most: the case of Tajikistan

Tajikistan illustrates the point that it is those countries least responsible for greenhouse gas emissions that cause global warming, which are suffering first and worst from its impacts. Tajikistan's carbon emissions are miniscule – the country is in 100th place in terms of carbon dioxide emissions, but the country is already seeing clear impacts from climate change.

In Tajikistan, negative impacts from climate change have resulted in a deteriorating quality of life for people, and have forced many to migrate. In the wide valleys the annual average temperature has increased by 0.7 to 1.2°C, and this increase is higher in the cities. Though these averages can be misleading: temperatures in summer and in certain parts of the country can be almost 5 degrees hotter than usual. Rainfall has become erratic; some territories have less precipitation than others. While not abnormal for a mountain country, the number of hot days now greatly outnumbers the cold days.

The rapid melting of glaciers combined with heavier and more intense rainfall creates especially dangerous conditions and can cause more floods and avalanches. The water regime has become much less sustainable, and the outdated irrigation systems are incapable of preserving and storing water anymore. Although the amount of annual rainfall may not have declined overall, it falls in more intense bursts and – unable to capture or preserve it – people are facing increasing lack of water for agricultural needs.

The melting of glaciers is a global phenomenon that is both a portent and warning of global warming. Tajikistan generates 55 percent of all the water in the Aral Sea Basin shared with four other countries, and Tajikistan's mountain glaciers contain 25 to 50 percent of that amount. In 1949 glaciers covered 18,000 square km of the country's territory. Satellite images from 2000 indicate that this area has shrunk to 11,863 square km – a 35 percent decrease in just 50 years.

The country's First National Report on the UN Framework Convention on Climate Change (2002) and subsequent National Action Plan (2003) sombrely concludes, "in the mid- and long-term perspective a catastrophic reduction in stream flow in many rivers is expected".

The government of Tajikistan is aware of the problem and uses its network of meteorological observers and local administrations to raise people's awareness. The National Action Plan has been developed in order to help the local communities and country in general to adapt to climate changes. It is necessary to prepare for natural disasters, to reinforce drainage and irrigation systems, and – of utmost importance – to modernize agriculture to make it more advanced and flexible in its reaction to water availability. However, this problem remains a difficult concept to communicate at the village level. Rural people often regard this problem as a temporary one and less important than many other pressing problems they face every day.

Women's traditional responsibilities for collecting water, rearing livestock and cultivating crops mean that they are on the front line of climate change. In Panjhok village in

mountainous northwestern Tajikistan, the shortening growing season has increased food insecurity, particularly for women.^{xxiii}

In early 2007 two Tajik organizations, the Youth Ecological Forum and For Earth Planet, sampled community perceptions in four regions of Tajikistan. People in all the study areas said they were witnessing two main changes: greater extremes of temperature, with hotter summers and colder winters, and less predictable rainfall and snow. Both snow storms and heat waves are increasing.^{xxiv}

Many respondents said that this worsening climate had reduced their incomes, with heavy damage done to wheat, livestock, melons and gourds. As a result, people's migration to neighbouring regions and countries, including Russia, increased in some regions and so did conflicts between communities over water.

Statements from people recorded by NGOs, in particular Oxfam, demonstrate the seriousness of the problem and concern for solutions. "There have been more disasters here in the last two years and more floods," says Mahmad Kabir, a member of the local Kulyab emergency committee in Southern Tajikistan. "There are no early warning systems in place after the collapse of the Soviet Union so we cannot predict when a disaster will happen. The climate has become hotter and snow has melted from the high mountains, which has meant that we have more mudflows and floods. Because some people do not have the money to build their houses well, they collapse. When natural disasters strike, people are displaced and forced to move, they have to change their entire lives."

Challenge to humankind

Human societies face an unprecedented and terrifying challenge, with extraordinary amounts of people likely to be exposed to increased hunger and water stress as a result of climate change – for example, by 2025 more than 3 billion people could be living in countries facing 'water stress.'^{xxv} It is difficult to speculate how societies will change and when – before or after the danger point is passed? To avert the threat, societies will have to radically change – and fast – some of their structures and behaviours in order to conserve energy and reduce oil consumption.

Ultimately, climate change asks questions of us all as to what sort of global human society we want to belong to. No society is immune – we are truly all in this together. In the spirit of the UN Framework Convention on Climate Change (UNFCCC), however, different countries do bear 'common but differentiated' responsibilities. Societies that bear the greatest historical responsibility for emissions and whose accumulated wealth gives them greater capacity to act, must both reduce their own emissions and help poorer countries adapt.

Climate change is already creating, and will almost certainly continue to create, additional pressures on people in some countries to move – either internally, towards cities, or across borders. Motivations for migration are diverse – it is often a last resort and at least as much due to the pull of economic opportunities and a better life as it is to the push of floods or droughts. But that balance could switch in future years if weather calamities increase.

Unless the biggest greenhouse gas emitters take urgent international action to reduce their emissions, impacts on people, interacting with other environmental problems, will mount along with the temperature – and economic and social problems will increase. There are steps we can all take to avert the worst impacts which could be to come, and to help the poorest and most vulnerable to adapt to changes that are already happening. Urgent actions are needed now.

Recommendations for Russia and its neighbours

These recommendations include two main elements: the reduction of greenhouse gas emissions, and the introduction of adaptation measures. Adaptation measures alone will not solve the problem. Emission reductions are crucial - and without urgent action, climate change will become so powerful that humankind will not be able to cope with it. Already, poor and vulnerable men, women and children are experiencing the impacts of climate change, which hit the poorest hardest. The national and regional initiatives recommended below should put poor people's needs first.

Russia needs to play a leadership role in the G8 and under UN climate negotiations to achieve a post-2012 agreement that ensures:

- Global emissions peak and begin to decline by no later than 2015, falling by at least 80 percent by 2050 (relative to 1990 levels)
- Rich countries take immediate action to cut their emissions, with target emissions reductions of at least 25 to 40 percent below 1990 levels by 2020
- Rich countries pay their fair share of adaptation and mitigation costs in developing countries.

Political and economic initiatives are needed that are compatible with the global strategy of low-carbon development. Under the conditions when "abnormal weather becomes a normal thing" concrete measures are required from the Russian government, along with awareness and involvement of people, business and non-governmental organisations. These measures should:

- Identify and define an energy strategy for Russia through 2030.
- Introduce fuel-efficient standards for energy and heat, create penalties for non-compliance, and provide incentives for the development of innovative energy technologies.
- Adopt a 25-year plan to introduce fuel saving standards for new cars, with immediate standards, adjusted to international norms, within the next 5 years.
- Adopt a 25-year plan to introduce new norms and rules for the construction of new and reconstruction of old buildings with the goal of reducing the amount of energy consumed by the country's economy by 25 percent per unit of GDP within the next 5 years. A further 20 percent reduction should follow each 5 years.
- Develop Regional plans that prioritise the needs of poor and vulnerable groups of the population, especially where climate change will have the most negative impacts – such as Chukotka, and other arctic regions like Kamchatka and Tuva.

- For South Russia and the North Caucasus, it is necessary to prepare for unfavourable river run-offs and shortage of water. Measures should include: transition to state-of-the-art irrigation systems, hydro technical facilities, drought-resistant crops, construction of anti-flood defence facilities, and planting of defensive forest belts.
- For Central Russia it is necessary to prepare for a more “intensive but rare” precipitation regime, more frequent storms and hurricanes, recurrent heat waves, flooding of the lowland located in historical centres of towns. It is necessary to introduce measures to protect St. Petersburg specifically from more frequent and large-scale floods caused by storms and the rise of the sea level.
- Monitoring the impact of climate change on the quality of drinking water and air, and the impact of high temperatures on people’s health. Groups most vulnerable to the impact of heat (the elderly and children) should be equipped with air-conditioning.
- Create a Russian National Action Plan that addresses among other things the problem of the spread of contagious diseases caused by parasites. This problem should be given a high priority – all necessary vaccines should be obtained and all medical personnel should be trained beforehand. Priority should be given to the protection of poor and vulnerable groups.
- Russia should assist Central Asian countries in solving the problems of water shortage and exacerbated irregular river channelling. This assistance could include co-operation in the introduction of state-of-the-art irrigation systems, construction of hydro-technical facilities, and introduction of drought-resistant crops.
- Russia should render assistance to the Central Asian countries in building a more advanced and technically equipped healthcare system, especially for the most vulnerable groups of their populations – women and children.
- Central Asian countries should develop economic spheres less tied to water resources, introduce industries to replace agriculture, and stimulate the development of small business. These measures could help prevent mass migrations caused by water shortages.

ⁱ Interview of the Head of Roshydromet Alexander Bedritsky, February 6, 2008. See also Report of Roshydromet on Climate Specific Features in the Russian Federation in 2007, Moscow, 2008, --35 pp.

ⁱⁱ Materials for Strategic prognosis for climate change in the Russian Federation in 2010-2015 and its impact on Russian economy, 2005. Roshydromet. M.: p. 90

ⁱⁱⁱ *ibid.*

^{iv} Russia’s Fourth National Communication to the UN FCCC and Kyoto Protocol, 2006. Roshydromet, M., p. 82, www.unfccc.int

^v Data on Central Asia given according to: S. K. Alamanov, V. M. Pelevkin, O. A. Podrezov, A. O. Podrezov. Climate change and water problems in Central Asia. Educational course for natural sciences and humanities students, Moscow-Bishkek, WWF Russia, UNEP, 2006, p. 188.

^{vi} *Ibid.* See also Materials of glacier studies. M., 2004, vol. 97

^{vii} IPCC, 2001, Third Assessment Report, vol. 1. www.ipcc.ch

^{viii} Anisimov O. A. Potential feedback of thawing permafrost to the global climate system through methane emission. *Environ. Res. Lett.* 2 (2007) in print (7 pp)

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- ^{ix} O. A. Anisimov, M. A. Belolutskaia, 2002. Assessment of climate change and permafrost degradation impact on the infrastructure in Russia's northern regions. *Meteorology and hydrology* (6): 15-22. O. A. Anisimov, S. A. Lavrov. 2004. Global warming and thawing permafrost: risk assessment for TEK industrial units. *TEK technologies* (3): 78-83.
- ^x ACIA, 2004. Arctic Climate Impact Assessment. Cambridge University Press, p. 139 www.acia.uaf.edu
- ^{xi} The comparison is based on the data collected on September of each year when the ice area is the smallest. National Snow and Ice Data Center (NSIDC), USA.
<http://www.wwf.ru/resources/news/article/3317> (in Russian).
http://nsidc.org/news/press/2007_seaiceminimum/20071001_pressrelease.html
- ^{xii} Observations of the native inhabitants of Chukotka autonomous county coastal districts concerning climate changes/ V. Kavry, A. M. Boltunov: WWF Russia, p. 16 –2006,
<http://www.wwf.ru/resources/publ/book/196/>
- ^{xiii} Ibid. Referred to here and below in this section, the data concerning climate change was collected by WWF Russia
- ^{xiv} ACIA, 2004. Arctic Climate Impact Assessment. Cambridge University Press, p. 139 www.acia.uaf.edu
- ^{xv} Fourth National Report of the Russian Federation on compliance with UN Framework Convention on Climate Change and Kyoto Protocol, 2006. Roshydromet, M. p. 85, www.unfccc.int
- ^{xvi} Materials for Strategic prognosis for climate change in the Russian Federation in 2010-2015 and its impact on Russian economy, 2005. Roshydromet, M.: p. 47
- ^{xvii} I. G. Gritsevich, CENEF, 2007.
- ^{xviii} Fourth National Report of the Russian Federation on compliance with UN Framework Convention on Climate Change and Kyoto Protocol, 2006. Roshydromet, M., p. 85, www.unfccc.int
- ^{xix} Materials for Strategic prognosis for climate changes in the Russian Federation in 2010-2015 and its impact on Russian economy, 2005. Roshydromet. M.: p. 13
- ^{xx} Climate Change. Set of information cards on climate changes, M.: UNEP, UN FCCC, 2003, p. 10
- ^{xxi} S. N. Bobylev, Climate change impact on agriculture and water resources in Russia – M.: Fund “Protection of the environment,” 2003, p. 35.
- ^{xxii} See “Drought Management Considerations for Climate Change Adaptation in the Mekong Region: Part 1, Vietnam,” by the People’s Committee of Ninh Thuan, Oxford-Vietnam and the Graduate School of Global Environmental Studies of Kyoto University, Japan, 2007. See
http://www.oxfam.org.uk/resources/policy/climate_change/downloads/ninh_thaun_research.pdf
See also “Up in Smoke? Asia and the Pacific” by the UK Working Group on Climate and Development at
http://www.oxfam.org.uk/resources/policy/climate_change/asia_up_in_smoke.html
- ^{xxiii} “Up in Smoke? Asia and the Pacific” by the UK Working Group on Climate and Development at
http://www.oxfam.org.uk/resources/policy/climate_change/asia_up_in_smoke.html
- ^{xxiv} “Report on Public Perceptions of Climate Change in Tajikistan and Kyrgyzstan,” Youth Ecological Centre, Dushanbe, Tajikistan, 2007.
- ^{xxv} See for example UNDP Human Development Report 2006, Beyond scarcity: power, poverty and the global water crisis.